

RECOMMENDATIONS (CONTINUED) - Speedway Brook (Segment MA52- 05)

- Bristol Nursing Home: EPA/DEP should reissue permit with following revisions: flow unit should be GPD, a fecal coliform limit with a 3/X week monitoring requirement should be imposed, and the facility needs to disinfect its wastewater with appropriate monitoring requirements depending on disinfection methodology. The actual receiving water of the discharge (unnamed wetland to an unnamed tributary of Speedway Brook) should be corrected. In order to meet these new permit requirements the Bristol Nursing Home treatment system will need to be upgraded. Another option for the facility is to consider tying into the Attleboro WPCF. According to the Chief Operator of the Attleboro WPCF, the sewer line extends to the Locust Street/Oak Hill Road intersection (Nicholson 2000). When the Attleboro WPCF sewer is extended to Oak Hill Road and Briggs Corner (included in the 1996 Facilities Plan), the Bristol Nursing Home could tie into the sewer.
- Conduct 5-year review of Texas Instruments WMA permit limit and any permit conditions.
- Texas Instruments: EPA/DEP should finalize the NPDES permit after public comment period. The facility should continue to pump and treat contaminated groundwater. With the exception of stormwater, TI should connect all of their wastewater discharges (both Ten Mile and Taunton River Basins) with the Attleboro WPCF and comply with the pretreatment requirements of the cities system. The stormwater discharges will need to comply with TI's Stormwater Pollution Prevent Plan (SWPP) and performance standards as part of their general multisector stormwater permit.
- Continue to monitor fecal coliform bacteria densities in Speedway Brook (increase spatial and temporal sampling) to identify any source(s).

SEVENMILE RIVER (SEGMENT MA52-07)

Location: Outlet of Hoppin Hill Reservoir, North Attleborough to outlet of Orrs Pond, Attleboro.

Segment length: 3.0 miles. Classification: Class A Public Water Supply, Outstanding Resource Water

SEGMENT DESCRIPTION

Hoppin Hill Reservoirs tributaries originate in Plainville. The Sevenmile River exits Hoppin Hill Reservoir and flows south through an area of dense commercial development and activity. This segment receives a stormwater discharge from the Emerald Square Mall as well as runoff from a major six lane highway (Routes 295) and Route 1. The Sevenmile River flows through Luther Reservoir before entering Orrs Pond, which serves as a surface water withdrawal point for the Town of Attleboro's Public Water Supply.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	45%
Residential	16%
Agriculture	12%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	43%
Industrial	9%
Open Land	6%

WITHDRAWALS AND DISCHARGES

WMA:

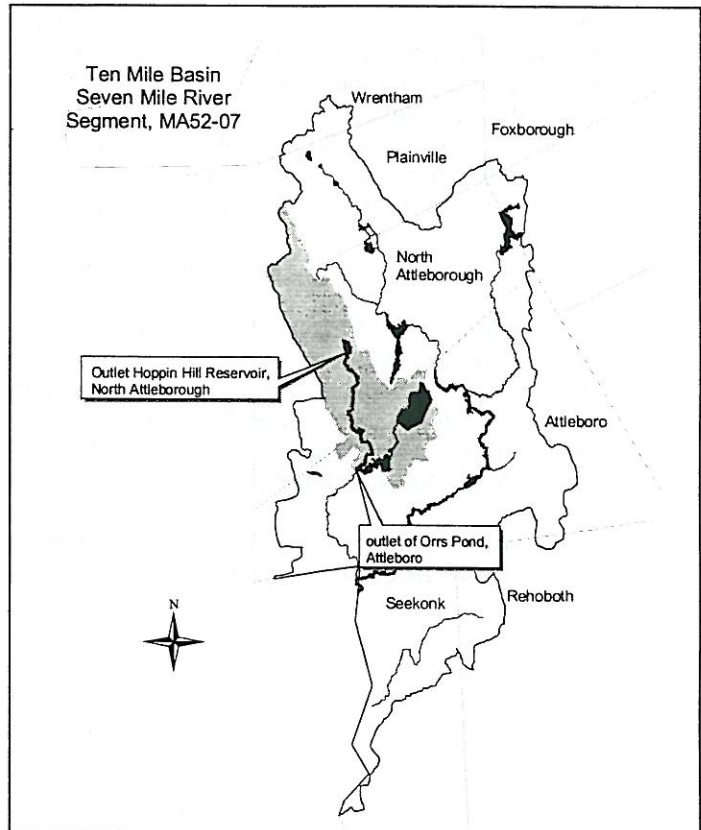
1. The City of Attleboro is registered (42701601) to withdrawal of 3.67 MGD from Orrs Pond and permitted (9P242701601) for an additional 0.15 MGD through 2001 from the same location. By 2011, the permitted volume will be 0.18 MGD.

NPDES:

1. MA0030244 Emerald Square Mall was issued a permit in September 1994 to discharge treated stormwater runoff via two outfalls 001 and 002 into a natural wooded riparian wetland adjacent to the Sevenmile River. Treatment is accomplished using artificial wetlands/settling ponds. Due to the fact that this segment of the Sevenmile River is a Class A waterbody (public water supply), the proponents were required to do an Environmental Impact Report (pursuant to MEPA regulations). As a result of the EIR process, the NPDES permit contains a detailed Best Management Practices Plan (BMPP) in addition to numerical limits for a wide array of chemical contaminants. There was good compliance with permit requirements and limits. The permit was reissued in September 1999.

USE ASSESSMENT







Water quality sampling was conducted by DWM at one location in the Sevenmile River downstream of Draper Avenue Bridge, North Attleborough (station SM00) (Appendix B, Table B1). This effort included fecal coliform sampling (once each day) and *in-situ* measurements of dissolved oxygen and other variables (early morning and late afternoon each day) using a Hydrolab®. Benthic macroinvertebrate sampling, qualitative periphyton sampling, fish population sampling and habitat assessments were also



conducted by DWM biologists upstream of Draper Avenue Bridge, North Attleborough (station SM00) in September 1997.

- Bioassessment/Habitat - Benthic macroinvertebrate community analysis resulted in a total metric score of 34 (as compared to a score of 42 at the regional reference site TM01) which indicates non/slight impairment at this station (Appendix B; Table B7). A slight dominance by amphipods and fingernail clams, as well as a low community similarity score account for the discrepancy with the reference community TM01. The high densities of filter-feeding pisidiid clams probably result from SM00's location downstream from Hoppin Hill Reservoir, as ponds and impoundments are often a contributing source of fine particulate organic matter (FPOM) to downstream lotic communities. The low scoring community similarity metric can probably be attributed to differences in flow regimes, drainage area (3.47 and 1.73 mi² at SM00 and TM01, respectively), and trophic structure between the two stations rather than water quality impairment at SM00. In fact, a richness of 29 different taxa was recorded at SM00—the most of any biomonitoring station in the basin—and most of the metric values were indicative of clean water and “best attainable” conditions. In particular, those attributes that measure components of community structure (e.g., taxa richness, EPT index)—which generally display the lowest inherent variability among the RBP metrics—scored well, corroborating its designation as a reference station. A small amount of sediment deposition and embeddedness impair habitat quality only slightly, and were noted in the habitat assessment. SM00 received a total habitat assessment score of 165 out of a possible 200—the highest habitat evaluation given to a biomonitoring station in the 1997 Ten Mile River survey (Appendix B, Table B9).
- Fish Population - Although the quality of fish habitat was rated as excellent at SM00, fish sampling resulted in the collection of only 19 fish representing three species (Appendix B; Table B10). Most fish (14) collected were young of the year of predominantly “pond species”. Only redbfin pickerel can be considered a “stream species”. Flows were relatively high, possibly as a result of water releases at Hoppin Hill Reservoir. It is unclear what the normal flow regime is in this segment of the Sevenmile River. Prolonged periods of reduced flow may be responsible for the low numbers of fish. It also appears that releases from Hoppin Hill Reservoir result in the displacement of stream species by predominantly pond species in this stream reach. It is also possible that releases are having a detrimental effect on the instream fish community. Based on the low number of fish and the lack of true stream species in excellent fisheries habitat, the aquatic life use is assessed as non support.
- Water Quality – SM00 - Although the data set was too limited to assess either the primary or secondary contact recreational uses, the fecal coliform densities ranged from 100 – 520 cfu/100 mls (Appendix B, Table B3). Temperature and pH met the criteria for a Class A water, however DO was less than 6.0 mg/L and 75% saturation during 50% of the sampling events (Appendix B, Table B2). The aesthetic quality of the stream, however, was excellent.

SUMMARY

Designated Uses		Status
Aquatic Life		NON SUPPORT. As a result of the low number of fish and the lack of true stream species in excellent fisheries habitat, the aquatic life use is assessed as non support.
Fish Consumption		NOT ASSESSED.
Drinking Water		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The aesthetic use is assessed as support for the entire 3.0 mile length of this segment.

RECOMMENDATIONS - Sevenmile River (Segment MA52-07)

- The assessment of water quality conditions in this segment has been based primarily on limited data. Biological sampling (fish community) indicates potential problems related to reduced flow; however, its classification as a Class A Water Supply overrides potential ecological consequences of flow alteration/augmentation. Efforts to minimize impacts to biological communities within this segment, however, should be pursued to the extent possible through operational best management practices (e.g., maintaining a minimum streamflow, implementation of ramping procedures, etc.) by the City of Attleboro.
- Conduct 5-year review of the City of Attleboro's WMA registration and permit limit and any permit conditions.
- The presence of fecal coliform bacteria in a Class A public water supply is a concern that merits further investigation/remediation.

FOURMILE BROOK (SEGMENT MA52-10)

Location: Outlet of Manchester Pond Reservoir, Attleboro to inlet of Orrs Pond, Attleboro.

Segment length: 0.9 miles. Classification: Class A Public Water Supply, Outstanding Resource Water

SEGMENT DESCRIPTION

Fourmile Brook originates as the outlet of Manchester Pond Reservoir and flows south through a wooded section then a small residential neighborhood and finally into Orrs Pond which serves as a water supply for the City of Attleboro.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	41%
Water	23%
Residential	18%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	46%
Residential	21%
Wetlands	17%

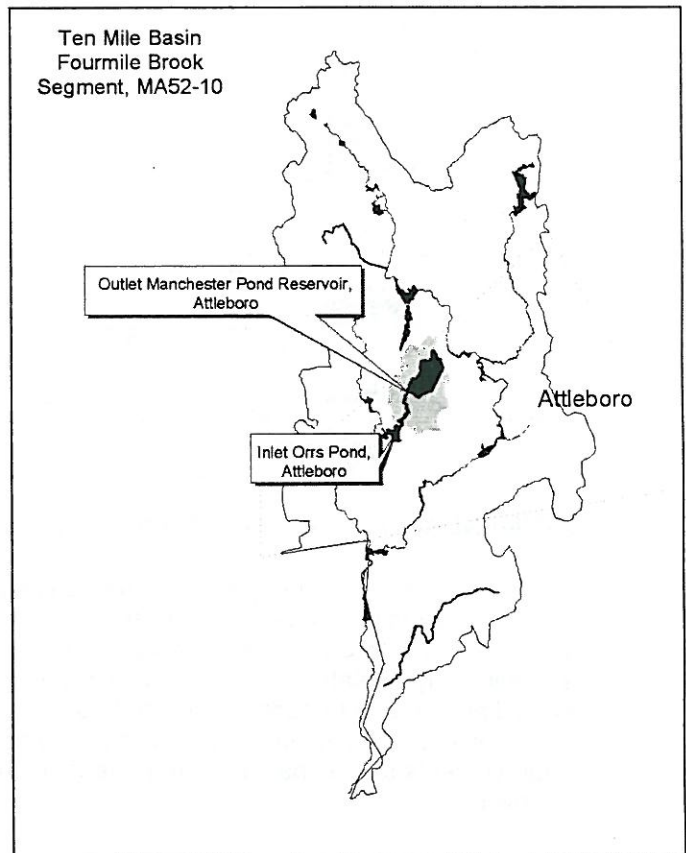
WITHDRAWALS AND DISCHARGES

None known.

USE ASSESSMENT



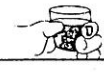



Water quality sampling in July, August, and September 1997 was conducted by DWM at one location in Fourmile Brook downstream of West St., Attleboro (station FM01) (Appendix B, Table B1). This effort included fecal coliform sampling and *in-situ* measurements of dissolved oxygen and other variables using a Hydrolab®. Qualitative sampling of the benthic macroinvertebrate community, qualitative periphyton sampling, and habitat assessment was also conducted by DWM biologists between Greenfield and West Streets in Attleboro (station FM01) in September 1997 (Appendix B, Table B4).

- **Bioassessment/Habitat**— Benthic macroinvertebrate habitat at FM01 was sub-optimal in most all of the categories evaluated, resulting in a total habitat assessment score of only 101—the lowest habitat evaluation of all the biomonitoring stations surveyed (Appendix B; Table B9). Impacts appear to be local nonpoint (e.g., riparian zone removal and disturbances, road and lawn runoff) in nature and threaten aquatic life in this segment. Most limiting to biological potential here was the extremely low base-flow conditions, as flow regime and current velocity are important hydrologic determinants of benthic community structure. Macroinvertebrate sampling, which was cursory due to these habitat and flow constraints, indicated no signs of gross organic pollution. Five EPT taxa were represented in the qualitative benthos sample (Appendix B, Table B5). The blue-green algae, *Lyngbya* sp., was abundant (Appendix B, Table B11). There is a question as to whether manipulation of Manchester Pond Reservoir results in prolonged periods of low-flow in Fourmile Brook or whether reduced flows are for the most part naturally occurring. Results of biological sampling indicate potential problems related to flow reduction, however not enough information exists to evaluate the status of the aquatic life use.
- **Water Quality** — Although the data set was too limited to assess either the primary or secondary contact recreational uses, the fecal coliform densities did not exceed 40 cfu/100 mls (Appendix B, Table B3). Temperature and pH met the criteria for a Class A waterbody, however dissolved oxygen



was slightly less than 75% saturation on two of six sampling occasions (Appendix B, Table B2). The aesthetic quality was considered very good.

SUMMARY

Designated Uses		Status
Aquatic Life		NOT ASSESSED.
Fish Consumption		NOT ASSESSED.
Drinking Water		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The aesthetic quality is assessed as support for the entire 0.9 mile length of the segment.

RECOMMENDATIONS - Fourmile Brook (Segment MA52-10)

- The assessment of water quality conditions in this segment has been based primarily on limited data. Biological sampling indicates potential problems related to reduced flow however the classification of this segment as a Class A water supply may override potential ecological consequences of flow alteration/augmentation. Efforts to minimize impacts to biological communities within this segment should be pursued through flow related operational BMPs by the City of Attleboro as well as a nonpoint source educational campaign aimed at residents of the Fourmile River sub-watershed. Improvements to the riparian zone are recommended particularly where residential lawns/yards abut the river.
- Additional monitoring for fecal coliform bacteria is needed in order to determine if Class A Standards are being violated.

SEVENMILE RIVER (SEGMENT MA52-08)

Location: Outlet of Orrs Pond, Attleboro to confluence with the Ten Mile River, Pawtucket, RI.
 Segment length: 3.0 miles. Classification: Class B, Warm Water Fishery

SEGMENT DESCRIPTION

This Sevenmile River segment extends from the outlet of Orrs Pond in Attleboro south through areas of wooded wetlands and residential development to the MA/RI border in Attleboro/Pawtucket R.I. The river appears to have been channelized in sections within this segment, possibly as an attempt to control flooding. There are no major discharges to this segment, however, the segment does receive stormwater runoff from Route 95 and Route 1A.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	42%
Residential	20%
Open Land	12%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	55%
Wetlands	29%
Open Land	7%

WITHDRAWALS AND DISCHARGES

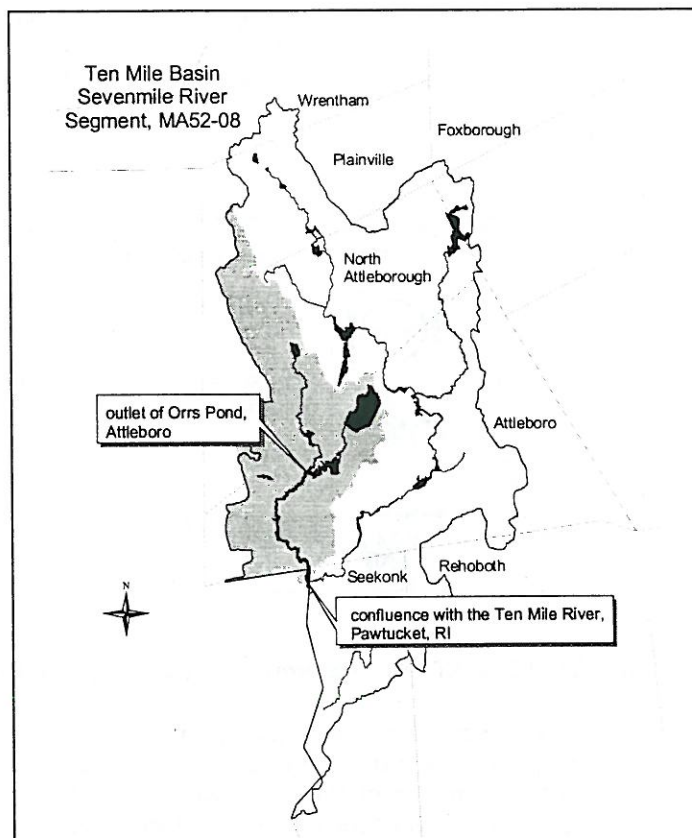
NPDES:

1. MA0002364—Craft, Inc. – In 1975 an NPDES permit authorized the facility to discharge non-contact cooling water via one outfall to the Sevenmile River. The facility reapplied for a new permit (permit application in 1983). In the application the facility indicated the NCCW discharge was approximately 720 GPD, pH of 6.1 SU and temperature of 22°C. There were also seven (7) additional stormwater outfalls from the facility. Permit application indicated pH in the range of 3.0 to 4.5 SU for the stormwater discharges. This facility is located just upstream of County Street, Attleboro.

USE ASSESSMENT






Water quality sampling (July, August, and September 1997) was conducted by DWM at one location in this segment of the Sevenmile River upstream of County St., Attleboro (station SM01) (Appendix B, Table B1). This effort included fecal coliform sampling and *in-situ* measurements of dissolved oxygen and other variables using a Hydrolab®. Fish population sampling was conducted by DEP DWM biologists at one station (SM02) located just downstream from Pitas Avenue, Attleboro (approximately a half mile upstream of County Street, Attleboro in October 1997.

- Fish Population/Habitat - Although fish habitat rated only fair (mostly in the form of woody limbs and branches), fish sampling resulted in the collection of a large number of tessellated darters (*Etheostoma olmstedii*) and redbfin pickerel (*Esox americanus americanus*) (Appendix B, Table B10). One creek chubsucker (*Erimyzon oblongus*), one white sucker (*Catostomus commersoni*), and one pumpkinseed (*Lepomis gibbosus*) were also collected. The fish sampling reach was highly channelized. The aesthetic quality of the stream reach was considered fair.



- Water Quality – SM01 - Although the data set was very limited, the fecal coliform densities were elevated in the Sevenmile River during dry weather sampling conditions (Appendix B, Table B3). The primary contact recreational use was therefore assessed as non-support. There is considerable residential development within the floodplain of the river in the vicinity of the reach sampled. A number of horse corals were also located within the apparent floodplain. Too little data was available, however, to assess either the secondary contact recreational or aesthetics use. Instream DO, % saturation, and temperature data met Class B standards (Appendix B, Table B2). Actually the instream temperatures were all < 20 °C (the cold water fishery criterion).

SUMMARY

Designated Uses		Status
Aquatic Life		SUPPORT. This use is assessed as support for the entire 3.0 miles based on the fish population and DO/temperature data, despite habitat impacts due to channelization.
Fish Consumption		NOT ASSESSED.
Primary Contact		NON SUPPORT. This use is non-support for the entire 3.0 miles due to elevated fecal coliform bacteria during dry weather conditions.
Secondary Contact		NOT ASSESSED.
Aesthetics		NOT ASSESSED.

RECOMMENDATIONS - Sevenmile River (Segment MA52-08)

- The assessment of water quality conditions in this segment has been based primarily on limited data. Fish population monitoring indicates that although habitat is fairly homogeneous and cover exists mostly in the form of snags and woody debris, this segment supports a relatively abundant fish population. Expressed desire by residents to clear woody debris in an attempt to reduce flooding should be strongly discouraged. Education with regard to nonpoint source pollution is also critical given the nature of the riparian zone (there is considerable residential development and a number of horse corals within the floodplain of the river) in the vicinity of the reach sampled. Cold, well-oxygenated water on all survey dates at SM01, and suggests that this segment could support trout. In light of the cool water temperatures (17.6 - 19 degrees °C) and high dissolved oxygen content, this segment is a good candidate for additional fisheries surveys to look for reproducing trout populations.
- Additional fecal coliform bacteria sampling is recommended under dry weather sampling conditions to identify any source(s) and to identify necessary corrective actions.
- Craft, Inc. needs to reapply to EPA/DEP for either an individual NPDES permit or apply for coverage under both the general NCCW and general or multi-sector stormwater permits for their discharges. The NCCW discharge should be screened for acute toxicity as part of their permit reissuance. Depending on the company's decision, either a reissued individual NPDES permit or new general permits should be developed.

COLES BROOK (SEGMENT MA52-11)

Location: Headwaters, Grassie Swamp west of Allens Lane, Rehoboth to inlet of Central Pond, Seekonk.
Segment length: 4.3 miles. Classification: Class B.

SEGMENT DESCRIPTION

Coles Brook originates in Grassie Swamp in Rehoboth. It flows southwest through forested wetlands, a country club, and a residential area before emptying into Central Pond in Seekonk.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	62%
Residential	15%
Open Land	12%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	52%
Open Land	20%
Wetlands	11%

WITHDRAWALS AND DISCHARGES

WMA:

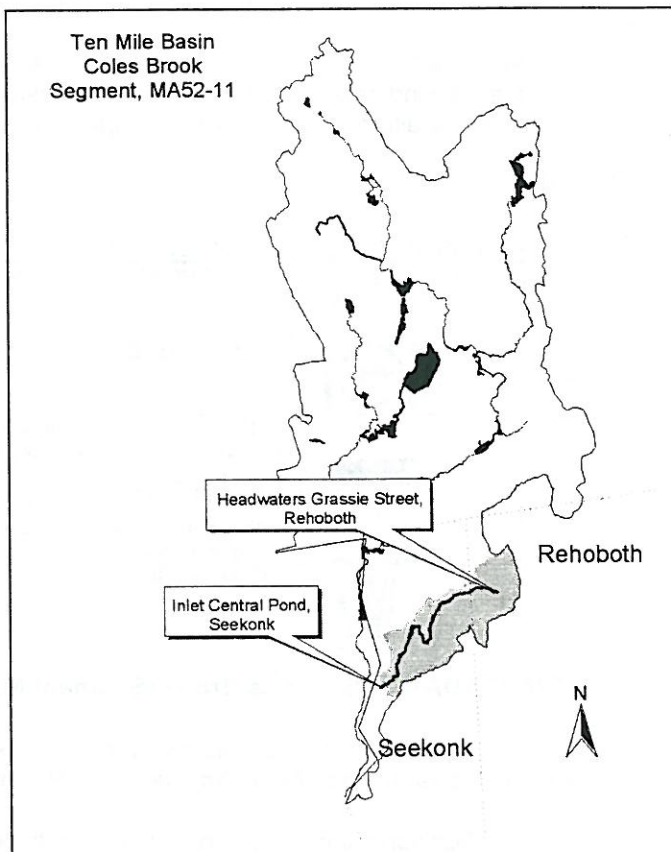
1. Seekonk Water District is registered (42726501) to withdraw 1.35 MGD of water (system-wide total) from five of their six sources located along the Coles River. (The sixth source is located in the subwatershed of an unnamed tributary to the Ten Mile River just north of the Coles River subwatershed.) The Seekonk Water Department is also permitted (9P42726501) to increase their registered withdrawal by 0.22 MDG by 2001.
2. Ledgemont Country Club is registered (42726502) to withdraw 0.09 MGD of water from two sources Country Club well and reservoir.

USE ASSESSMENT

Water quality sampling (July, August, and September 1997) was conducted by DWM at one location Coles Brook upstream of route 152 in Seekonk (station CB01) (Appendix B, Table B1). This effort included fecal coliform sampling and *in-situ* measurements of dissolved oxygen and other variables using a Hydrolab®. Flows were inadequate (too low) for Hydrolab® sampling during the July and August survey and for fecal coliform bacteria sampling during the August survey.

An *Assessment of Non-Point Source Pollution in the Coles Brook Subwatershed of the Ten Mile River Basin* (Fennessey, 1999) was prepared for the Massachusetts EOE through the Massachusetts Watershed Initiative Grant Program. In June 1998, following a near-record flooding event, bacteria entered the Seekonk Water District's Brown Avenue Wellfield (recharged by Coles Brook) and the wellfield was taken off-line. The focus of the study, coordinated by the Ten Mile River Basin Team Leader, was to identify the source of nonpoint bacterial pollution in the Coles Brook Subwatershed.






- Water Quality – SM01 - Fecal coliform densities were low in Coles Brook during dry weather sampling conditions (July survey) and elevated in Coles Brook in wet weather sampling conditions (September survey)(Appendix B, Table B3 and Results-survey conditions). Sampling conducted as part of the MWI Project *Assessment of Nonpoint Source Pollution in the Coles Brook*



Subwatershed of the Ten Mile River Basin (Fennessey 1999) corroborates these findings. Fecal coliform densities (data collected on 7 occasions at 7 locations on Coles Brook between 25 March and 20 May 1999) did not exceed 252 cfu/100 ml during dry weather sampling conditions but were as high as 19,900 cfu/100 ml during storm conditions. Based on these data, the primary and secondary contact recreational uses are assessed as partial support.

When sufficient flow was available in Coles Brook to measure DO, % saturation, and temperature, the data indicate that Class B standards were met (Appendix B, Table B2). It was obvious, however, that flow alterations (lack of flow) impair the aquatic life use in Coles Brook.

SUMMARY

Designated Uses	Status
Aquatic Life 	NON SUPPORT. The 4.3 mile segment does not support the aquatic life use due to a lack of flow.
Fish Consumption 	NOT ASSESSED.
Primary Contact 	PARTIAL SUPPORT. The 4.3 mile segment partially supports this use as a result of elevated fecal coliform densities in wet weather conditions. Additional monitoring would be required to isolate source(s).
Secondary Contact 	PARTIAL SUPPORT. The 4.3 mile segment partially supports this use a result of elevated fecal coliform densities in wet weather conditions. Additional monitoring would be required to isolate source(s).
Aesthetics 	NOT ASSESSED.

RECOMMENDATIONS - Coles Brook (Segment MA52-11)

- The following are recommendations from the *Assessment of Nonpoint Source Pollution in the Coles Brook Subwatershed of the Ten Mile River Basin* (Fennessey 1999):
 1. Additional sampling is necessary (both wet and dry weather) to determine whether any consistent source(s) of coliform bacteria can be identified. Additional spatial coverage may also be necessary.
 2. Future study should incorporate DNA "finger printing" to distinguish sources (e.g., human, avian, domestic or wild animal).
 3. Testing of Microscopic Particulate Analysis (MPA) of the Brown Avenue Wellfield must be performed twice per year. Depending on the results of the analysis, the Seekonk Water District may be required to provide filtration.
 4. The Seekonk Water District must improve its source protection measures for the Brown Avenue Wellfield prior to returning the source to service.
 5. Recommendations regarding the re-development of the Brown Avenue Wellfield must be submitted to DEP for approval.
- Although the cause of low flow problems is unknown, water withdrawals in the upper watershed appear to be contributing to low flow conditions in Coles Brook. Effects of the water withdrawals on streamflow in the Coles River watershed warrant further investigation.
- Conduct 5-year review of the Seekonk Water District's WMA registration and permit limit and any permit conditions. Minimize water withdrawals via conservation measures and any other permit conditions.
- Conduct 5-year review of the Ledgemont Country Club WMA registration.

LAKE/POND ASSESSMENTS

A total of twenty-two (22) lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been assessed in the Ten Mile River Basin. Sixteen (16) of the lakes are less than 50 acres in total surface area, and six (6) of those are less than ten (10) acres. The lakes surveyed in 1997 are located wholly or partly within six (6) different communities. Not surprisingly, however, the three major communities in this small watershed (Attleboro, North Attleborough, and Plainville) contained over three-quarters (77%) of the lakes. Four lakes in the Ten Mile River Basin are located partially or wholly in Rhode Island. These lakes (Pawtucket Pond, Central Pond, Ten Mile Reservation Pond, James V. Turner Reservoir) are assessed in this report but not shown in Figure 5. The total surface acreage of the Ten Mile Basin lakes is 1,315. Of that total, 80 %, or 1,049 acres, was assessed during the 1997 surveys. Designated water supplies (i.e., Class A) accounted for over half (29% or 308 acres) of the assessed acreage.

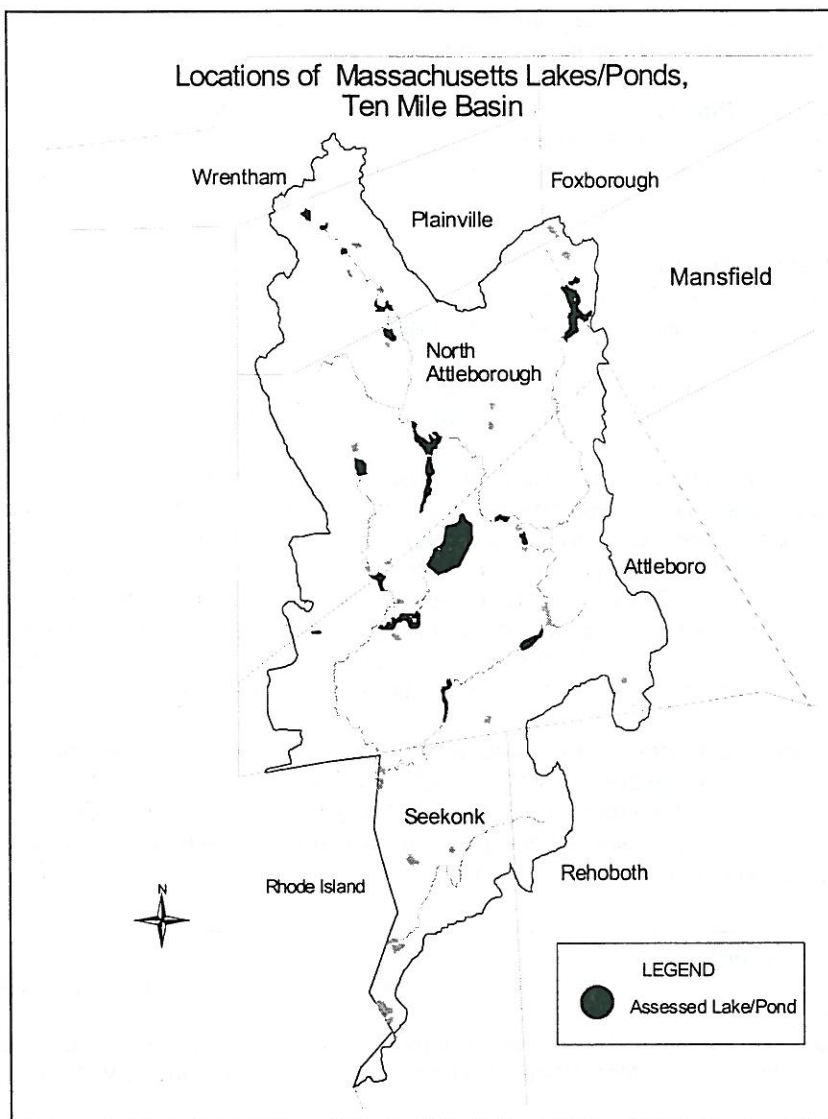


Figure 5. Location of Massachusetts lakes assessed in the Ten Mile River Basin.

LAKE USE ASSESSMENTS

Synoptic surveys were conducted, during the summer of 1997, at a total of 22 lakes in the Ten Mile River Basin. Surveys consisted of taking observations from at least one access point on each lake (multiple access points on larger lakes). At each lake, an attempt was made to observe the entire surface area to determine the extent of areal macrophyte cover. The trophic status of each lake was estimated and the presence of non-native aquatic and/or wetland plant species was also noted (Appendix B, Table B13). The data gathered during these synoptic surveys, as well as MDPH Fish Consumption Advisories (MDPH 1998), were used to assess the status the designated uses.

AQUATIC LIFE

Individual lake survey data are presented in Appendix B, Table B13. Surveys focused on the presence or absence of non-native macrophytes. Three non-native aquatic species and two non-native wetland species were observed in the Ten Mile River Basin lakes, as follows.

Non-native Aquatic Plants

Cabomba caroliniana - Fanwort

Myriophyllum heterophyllum - Variable water milfoil

M. spicatum - Eurasian water milfoil

Non-native Wetland Plants

Lythrum salicaria - Purple loosestrife

Phragmites australis - Common reed grass

Of the 22 lakes surveyed, only four (4), or 18%, had a confirmed non-native aquatic macrophyte observed. In the case of wetland species eighteen (18), or 82 %, lakes had non-natives associated with them.

Non-native plant species represent a special cause of impairment that is not always directly related to the cultural eutrophication process. Since these species are introduced from other parts of the country or world they are generally free from the natural control mechanisms (e.g., insects or diseases) that keep most native plant populations in check. Without controls the populations of many non-native species can grow rapidly to out-compete native plant species. This growth habit is termed invasive. It throws the biological community out of balance and can impair uses such as swimming (primary contact) and boating (secondary contact). In Massachusetts, the Division of Watershed Management is tracking the distribution of about a dozen of these non-native aquatic and wetland plant species and the impairment they are causing.

In the Ten Mile River Basin occurrences of the three non-native aquatic species were limited to one or two lakes. These are particularly invasive species that reproduce vegetatively via cuttings, so they have strong potential to spread downstream, if they have not done so already, into unsurveyed lakes or segments of tributaries. The listings below indicate where non-native, aquatic species have been observed (**in bold**) and the likely, or potential, avenues of downstream spreading:

Cabomba caroliniana (Fanwort)

-- **Lake Como** (Attleboro) ⇒ unnamed tributary ⇒ Sevenmile River ⇒ Ten Mile River (through Ten Mile Reservation Pond, Central Pond, and James V. Turner Reservoir)

-- **Plain Street Pond** (Mansfield) ⇒ Greenwood Lake ⇒ Bungay River ⇒ Ten Mile River (through Mechanics Pond, Dodgeville Pond, Hebronville Pond, Ten Mile Reservation Pond, Central Pond, and James V. Turner Reservoir)

Myriophyllum heterophyllum (Variable water milfoil)

-- **Falls Pond, South Basin** (North Attleborough) ⇒ Falls Pond, North Basin ⇒ Ten Mile River (through Farmers Pond, Mechanics Pond, Dodgeville Pond, Hebronville Pond, Ten Mile Reservation Pond, Central Pond, and James V. Turner Reservoir)

Myriophyllum spicatum (Eurasian water milfoil)

-- **Orrs Pond** (Attleboro) ⇒ Sevenmile River ⇒ Ten Mile River (through Ten Mile Reservation Pond, Central Pond, and James V. Turner Reservoir)

FISH CONSUMPTION

The fish consumption use assessments were based strictly on the MDPH fish consumption advisory list (1998). With the exception of the statewide MDPH health advisory, which warns that pregnant women should not consume fish from any inland Massachusetts waters, there are currently no specific non-consumption advisories in effect for any lakes in the Ten Mile River Basin.

PRIMARY AND SECONDARY CONTACT RECREATION AND AESTHETICS

Because the synoptic surveys focus on just three criteria (macrophyte cover, transparency, and biocommunity modifications) only a few uses could be assessed fully. Since macrophyte cover is the only criterion used to assess the secondary contact recreation, this use category was assessed at each lake surveyed. Lakes exhibiting impairment of the primary contact recreation use (swimmable) because of macrophyte cover and/or transparency were noted as either partial or non-support. However, if a lake met these criteria it, or part of its area, was listed as not assessed because no data were available for fecal coliform bacteria. The same approach was used for assessing the aquatic life use category since no dissolved oxygen data were available. The aesthetic use category was generally assessed at the same level of impairment as the more severely impaired recreational use category (primary or secondary contact recreation).

SUMMARY

With the above qualifications for the overall assessment of lake resources in the Ten Mile River Basin, the surveys indicated that the use of about 36 % of the surveyed surface acreage is impaired (Table 4). Two lakes (Chestnut Street Pond in Plainville and Pawtucket Pond in Seekonk/Pawtucket, RI) exhibited a complete loss of open water habitat apparently due to flow alterations. Whether accidental or intentional, both ponds have been drained so that only a stream channel and adjacent wetland vegetation remain.

Due to the focus of the surveys conducted, the major cause for use impairment was aquatic plants, either native or non-native (Table 4). Turbidity was also noted occasionally as a cause. These causes may reflect symptoms of lake eutrophication, a process of enrichment from excessive plant nutrients and sediments being introduced to the lakes from cultural activities. This phenomenon is also reflected in the distribution of lake trophic conditions, which is skewed toward the more eutrophic categories. The only other cause listed for impaired lakes in this watershed is flow alteration, which occurred when in two ponds as noted above.

The sources of impairment are largely unknown, at least based on direct knowledge. However, it can be surmised that nutrients delivered from storm water runoff and other nonpoint sources are likely to cause the increased algal or macrophyte productivity that has resulted in impairments.

RECOMMENDATIONS

- For non-native aquatic or wetland plant species that were isolated to one or a few location(s) (*Cabomba caroliniana*, *Myriophyllum heterophyllum*, *Myriophyllum spicatum*, and *Phragmites australis*) quick action is advisable to manage these populations in order to alleviate the need for costly and potentially fruitless efforts to do so in the future. Two courses of action should be pursued concurrently. More extensive surveys need to be conducted, particularly downstream from these recorded locations, to determine the extent of the infestation. And, "spot" treatments should be undertaken to control populations at these sites before they spread further. These treatments may be in the form of carefully hand pulling individual plants, in small areas, or selective herbicide applications in larger areas. In either case, the treatments should be undertaken prior to fruit formation and with a minimum of fragmentation of the individual plants. These cautions will minimize the spreading of the populations.
- The wetland species *Lythrum salicaria* has become more wide-spread in the Ten Mile River Basin lakes and wetlands. Accordingly, these species will require an extensive program aimed at 1) determining the extent of the distribution, 2) reducing impairment, and 3) controlling further spreading to unaffected waterbodies.

TABLE 4. Status of Ten Mile River Basin lakes surveyed in Summer 1997.

LAKE	LOCATION	SIZE (Acres)	TROPIC STATE	USE ATTAINMENT (Acres)	IMPAIRMENT CAUSE(S)
Cargill Pond	Plainville	5	E	1° Contact-P(2);N(3) 2° Contact-P(2);N(3) Aesthetics-P(2);N(3)	Noxious plants Turbidity
Central Pond	Seekonk,MA/ Pawtucket/ Providence, RI	139	H	1° Contact-N(14);U(125) 2° Contact-F(125);N(14) Aesthetics-F(125);N(14)	Noxious plants
Chestnut Street Pond	Plainville	10	--	Aquatic Life-NA(10) Fish Consumption-NA(10) 1° Contact-NA(10) 2° Contact-NA(10) Aesthetics-NA(10)	Flow alteration
Lake Como	Attleboro	5	H	Aquatic Life- P(5) 1° Contact-N(5) 2° Contact-N(5) Aesthetics-N(5)	Non-native plants (Cc) Noxious plants Turbidity
Dodgeville Pond	Attleboro	47	H	1° Contact-P(27);N(20) 2° Contact- P(27);N(20) Aesthetics- P(27);N(20)	Noxious plants Turbidity
Falls Pond (North Basin)	North Attleborough	62	E	1° Contact-P(62) 2° Contact-P(62) Aesthetics-P(62)	Turbidity
Falls Pond (South Basin)	North Attleborough	60	M	Aquatic Life-P(60) 2° Contact-F(60) Aesthetics-F(60)	Non-native plants (Mh)
Farmers Pond	Attleboro	9	H	1° Contact-P(9) 2° Contact- P(9) Aesthetics- P(9)	Noxious plants
Fuller Pond	Plainville	4	E	1° Contact-N(4) 2° Contact-N(4) Aesthetics-N(4)	Noxious plants
Greenwood Pond	Mansfield/ North Attleborough	153	M	2° Contact-F(153) Aesthetics-F(153)	
Hebronville Pond	Attleboro	16	H	1° Contact-N(16) 2° Contact-N(16) Aesthetics-N(16)	Noxious plants
Hoppin Hill Reservoir **	North Attleborough	30	U	2° Contact-F(30) Aesthetics-F(30)	
Luther Reservoir **	North Attleborough/ Attleboro	12	E	1° Contact-P(12) 2° Contact-P(12) Aesthetics-P(12)	Turbidity
Manchester Pond Reservoir **	Attleboro	218	U	2° Contact-F(218) Aesthetics-F(218)	

** Indicates Class A (water supply) waterbody; all others are Class B. INFORMATION CODES: **Trophic State**– O= Oligotrophic, M= Mesotrophic, E= Eutrophic, H= Hypereutrophic, U= Undetermined. **Use Attainment**: N= Non-support, P= Partial support, F= Full support, T= Threatened, NA= Not-attainable, U= Undetermined. **Non-native Plants**: Cc= *Cabomba caroliniana*, Mh= *Myriophyllum heterophyllum*, Ms= *Myriophyllum spicatum*

TABLE 4 (continued). Status of Ten Mile River Basin lakes surveyed in Summer 1997.

LAKE	LOCATION	SIZE (Acres)	TROPHIC STATE	USE ATTAINMENT (Acres)	IMPAIRMENT CAUSE(S)
Mechanics Pond	Attleboro	9	H	1° Contact-P(5);U(4) 2° Contact-F(4);P(5) Aesthetics-F(4);P(5)	Noxious plants
Orrs Pond **	Attleboro	48	U	Aquatic Life-P(48) 2° Contact-F(48) Aesthetics-F(48)	Non-native plants (Ms)
Pawtucket Pond	Seekonk, MA/ Pawtucket, RI	30	-	Aquatic Life-NA(30) Fish Consumption-NA(30) 1° Contact- NA(30) 2° Contact- NA(30) Aesthetics- NA(30)	Flow alteration
Plain Street Pond	Mansfield	15	H	Aquatic Life-P(15) 1° Contact-N(15) 2° Contact-N(15) Aesthetics-N(15)	Non-native plants (Cc) Noxious plants
Ten Mile Reservation Pond	Pawtucket, RI	19	E	1° Contact-N(14);U(5) 2° Contact-F(5);N(14) Aesthetics-F(5);N(14)	Noxious plants
James V. Turner Reservoir	Seekonk,MA /Providence, RI	124	H	1° Contact-N(12);U(112) 2° Contact-F(112);N (12) Aesthetics-F(112);N(12)	Noxious plants
Wetherells Pond	Plainville	13	E	1° Contact-P(4);N(9) 2° Contact-P(4);N(9) Aesthetics-P(4);N(9)	Noxious plants Turbidity
Whitings Pond	North Attleborough	21	M	2° Contact-F(21) Aesthetics-F(21)	

** Indicates Class A (water supply) waterbody; all others are Class B. INFORMATION CODES: **Trophic State**– O= Oligotrophic, M= Mesotrophic, E= Eutrophic, H= Hypereutrophic, U= Undetermined. **Use Attainment**: N= Non-support, P= Partial support, F= Full support, T= Threatened, NA= Not-attainable, U= Undetermined. **Non-native Plants**: Cc= *Cabomba caroliniana*, Mh= *Myriophyllum heterophyllum*, Ms= *Myriophyllum spicatum*

- As with the isolated cases, a program to manage the more extensive plant infestations should include additional monitoring efforts to determine the extent of the problem. Plant control aspects of any plan to manage the non-native aquatic species mentioned above can select from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.), each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should be discouraged because of the propensity for these plants to reproduce and spread vegetatively (from cuttings).
- Another important component of a management plan is prevention of further spreading of these plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations occurring in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake users to the problem and their responsibility for controlling the spreading of these species.

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